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DE 28 44 958 A1

Utilization of an adhesive film for detachable adhesive connections

Description

The invention is concerned with the utilization of an adhesive film that is meant for detachable and removable adhesive connections, specifically those of two components that need to be connected to each other, and with which at least one of the said components possesses a solid and stiff characteristic.

While it is common with the application of adhesive technology that two components that are to be connected with each other will be connected in a solid and lasting manner, and a later separation is neither considered nor desired, there are still adhesive connections that need to be separated from each other after a certain time duration due to the nature of their use application.

Self adhesive tapes, films or labels can be removed easily from solid surfaces by means of peeling loads. For example, it is known with adhesive bandages and similar objects (reference US Patent 43 35 026) to coat a carrier material that can be bent with an adhesive that contains elastomer components, and thus it should be avoided to injure the skin upon removal of said bandage.

It will become difficult in those cases in which solid and stiff materials will be attached by means of adhesion to solid, stiff surfaces. In some cases it might be possible to separate said adhesive connections without any destruction with the support of applied heat, or by means of swelling, and by dissolving the adhesive material with the support of solvents. However, a rather high involvement is associated herewith . and it is not possible to exclude any possible danger of damaging the components that are connected to each other by means of an adhesive material.

Thus, the scope of the invention was to make an adhesive system available that enables one, based on its specific characteristics, to create adhesive connections of solid and stiff components that can bear load applications, for example, information boards on display windows of shops or on wall coverings that are made of layered materials, and with which the said adhesive connections can be separated from said supporting substrates after a certain duration of time without any special effort and without causing any damages to the materials.

Surprisingly, that scope can be solved by means of utilizing a self adhesive or heat activated adhesive film that is constructed on the basis of a thermo plastic cautchouc and adhesion enhancing resins.

Systems of such a kind deliver a good adhesion strength and lasting adhesive connections after joining solid materials by means of adhesion. A pre-requisite for being able to remove such materials connected by means of adhesion is an adhesive film that possesses a high degree of elasticity and a low degree of plasticity. The adhesion needs to be lower than the cohesion, and the adhesive ability (self adhesive effect) needs to mostly disappear once the adhesive film is subject to a stretching process In order to separate a connection made with such an adhesive film, said film can now be pulled out of the

adhesion gap by means of applying a pulling force in the direction of the plane of the adhesive connection. This detachment of the adhesive connection is supported by the reduction of the thickness of said film caused by the strong stretching effect. The removal force that is comprised of the sum of the forces needed for the deformation (elasticity and plasticity), and for the peeling (peeling of the adhesive film) is relatively low. Further aids are not required. With this removal technique – comparable to the opening of a zipper closure – the components that were attached to each other by means of adhesion will not be influenced.

Suitable as being thermo plastic cautchoucs following the central idea of the invention are, for example styrol butadiene block polymers, or styrol isoprene block polymers.

Suitable as adhesion enhancing resins are, for example, natural or synthetic resins such as hydrolyzed dis-proportionized, dimeryzed colophonium resins derivatives, for example, that can be present in an estered manner or as free acids, terpen and terpen phenol resins, synthetic hydrogen carbon resins, in order to name only a few possiblities.

Furthermore, it is possible to add to the elastomer resin system anti oxidation agents, UV stabilizers, dyes, fillers, and other common additives – in the manner as they are known to an specialist in the adhesion technology.

The elastomer component supplies the system with the required rubber elasticity and cohesion without requiring any vulcanizing process, while the resin is mainly responsible for the adhesion to the various substrate surfaces. The combination takes place following the state of the art of this technology,

The listed raw materials can be dissolved in a solvent, for example, gasoline, and they can be applied with the support of a pull rake as a high percentage solution on to separation paper or separation film and be dried in a drying tunnel. This material can be slit into rolls. The production is made simpler for the case that the raw material mixture will be kneaded in a hot condition and will be extruded on to separation paper at a temperature that ranges between 120 – 160° C.

The adhesion process and the testing of the adhesive strength takes place following the common techniques of the adhesive industry. It is of advantage with said product to utilize it for the adhesive attachment of all kinds of stiff and solid objects to each other, such as information boards onto display windows of shops, of pictures or mirrors to walls and glass panes, display materials to display stands or scaffolds, but also paper or photographs onto sufficiently stiff support surfaces.

The fact that the thickness of the adhesive film is of high importance for the removal effect is demonstrated by means of the following, simplified consideration. For the case that a certain adhesive film that possesses a thickness of 0 6 mm displays a removal force of 20 N and a rupture force of 50 N, and a film that possesses a thickness of 1.2 mm displays 30 and 100 N, it is possible to create the following table according to the equation: removal force = force for the deformation and force for the peeling.

Thickness (mm)	Deformation (N/25 mm)	Peeling (N/25 mm)	Removal force (N/25 mm)	Rupture force (N/25 mm)
1.2	20	10	30	100
0.6	10	10	20	50
0.3	5	10	15	25
0.15	2.5	10	12.5	12.5

It can be seen from this calculation in principle that the thoughts of the invention apply only to the utilization of films that have a certain minimum thickness, but it will not apply to very thin films with which the removal force approaches the dimensions of the rupture load. In general – with comparable adhesion and cohesion – the adhesive film will rupture during the peeling off process. Because of safety reasons relation of the peeling away force to the rupture load shall be in the range of 1 : 2 to 1 : 3. Higher relation numbers require even thicker films with which the upper limit is determined by means of the economical conditions.

Example

10 kg styrol butadiene block polymer cautchouc (viscosity of a 25 percent solution in toluol: about 4 pa • s),
10 kg resin = hydrolyzed colophonium estered with pentaerhydrite, and
0.2 kg anti oxidants (based on aromatic amine) will be kneaded for two hours

at about 150° C, and extruded at 120 – 160° C to a 0.6 mm thick, self adhesive film, and said film will be covered at one of its sides by means of a separation paper (liner). For the purpose of further experiments the material was slit into 25 mm wide rolls.

Rupture load: 50 N/25 mm
Elongation: more than 1200%

Straight peeling resistance of an aluminum/GFK adhesive connection g (pressed together at 80° C with 10 bar): 1 N/mm²

Pull shearing resistance (binding strength) of an aluminum/aluminum adhesive connection

- Pressed with 10 bar at room temperature: 4.4 N/mm²
- Pressed with 10 bar at 80° C: 5.0 N/mm²

A polymer acrylic sheet attached by means of adhesive film to a sheet made of layered composite material (for an easier removal one allows a few millimeters of the adhesive film to extend out of the sheets in order to be used as a handle), and having the adhesive film pulled away following the central idea of the invention, results in a removal force of: 20 N/25mm, elongation: about 1000% with which a dramatic reduction of the film thickness from 0.6 to 0.2 mm takes place, and following this there is barely any self adhesive characteristic left in. the film.

Patent Claims

1. Utilization of an adhesive film to be used for detachable, removable adhesive connections on the basis of
   a) a thermoplastic cautchouc and
   b) adhesion enhancing resins, with which the adhesive film
   c) possesses a high elasticity, and
   d) a low plasticity, and with which
   e) the adhesion is lower than the cohesion,
   f) and with which the adhesive strength mostly disappears upon stretching of the film,
   g) and with which the relation of the peeling away force to the rupture load is 1:2 or, larger, and with which
   h) an adhesive connection that has been created in such a manner can be separated and removed again by means of pulling the adhesive film into the direction of the plane of said adhesive connection.
2. Utilization of an adhesive film according to claim 1, with which the mass is adjusted to be self adhesive.
3. Utilization of an adhesive film according to claim 1, with which the mass is adjusted to be heat activated.
4. Utilization of an adhesive film according to one of the claims 1 – 3, to be utilized for the adhesive connection of two components to be attached to each other, and with which at least one of two said components has a solid and stiff structure.
5. Utilization of an adhesive film according to one of the claims 1 – 4, that contain anti oxidizers, UV stabilizers, dyes, fillers, and/or other common additives.
6. Utilization of an adhesive film according to one of the claims 1 – 5, that possess a thickness of 0.2 mm to 0.6 mm.
7. Utilization of an adhesive film according to one of the claims 1 – 6, that contain a styrol butadiene block polymer as being the thermo plastic cautchouc, and a colophonium derivative as being the adhesion enhancing resin.
8. Utilization of an adhesive film according to one of the claims 1 – 7, with which the relation of the peeling force to the rupture load is 1 : 2 to 1 : 3.
9. Utilization of an adhesive film according to one of the claims 1 – 8, with which the mixture of the raw materials has been kneaded and extruded under applied heat.

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